§4. Performance of Assembly of Pulse Height Analyzer with Radial Scanning System

Muto, S., Kato, A., Morita, S.

In Large Helical Device (LHD), an assembly of pulse height analyzer has been developed for observing the radial profile of x-ray spectrum.

The assembly is installed on the #2.5-L port (lower port), and basically equipped with a radial scanning system and three detectors.[1] The detectors are arranged along the major radial direction with a spacing of 300 mm.

Each detector is the same one which comprises four pre-amplifiers, a portable liquid nitrogen cryostat, and four Si(Li) elements mounted inside a vacuum enclosure with a Be window (12.5 μm thickness). A data-acquisition-system for high counting rate has been used. In actual experiments, a flux of 100 kcps has been normally obtained with energy resolution better than 300 eV at the K_α line of Fe.

The scanning system modulates the sight lines of the detectors in the major radial direction. The positions of the sight lines are also identified. The normal positions are R3450, R3750, and R4050, respectively. Therefore, each detector covers a range of 300 mm. The spatial resolution of the scanning is dependent on the velocity of the modulation and accumulation time for a spectrum.

The assembly has been fully operated, and radial profiles of x-ray spectra have been successfully obtained. Figure 1 shows a typical spectrum observed through an external Be filter (200 μm in thickness). The radial profile of electron temperature can be estimated in a shot as is shown in the Fig.2. During the scanning, the time evolution of electron temperature is confirmed to be approximately constant by another pulse-height-analyzer. Figure 3 shows the intensity profiles of K_α lines emitted from Ti, Cr, and Fe, respectively.

The further improvement must be made in order to achieve the design performance of the assembly. In particular, time evolution of radial profile will be expected.

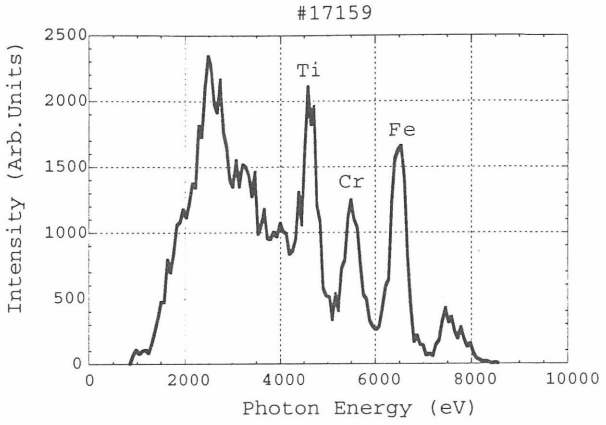

Fig.1. Typical spectrum measured with the assembly. The lines observed in the spectrum are corresponding to K_α lines emitted from Ti, Cr, and Fe,respectively.

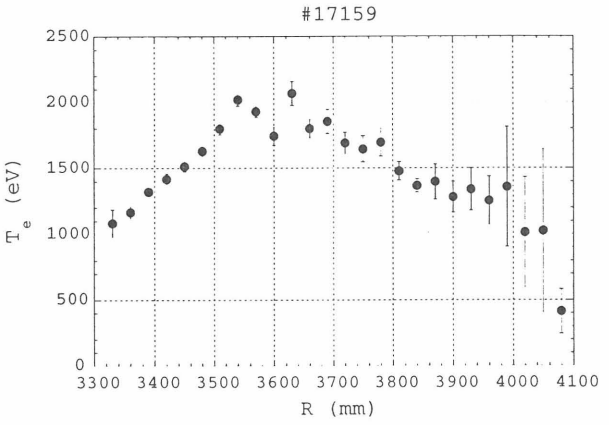

Fig.2. Radial profile of electron temperature estimated from an experimental result.

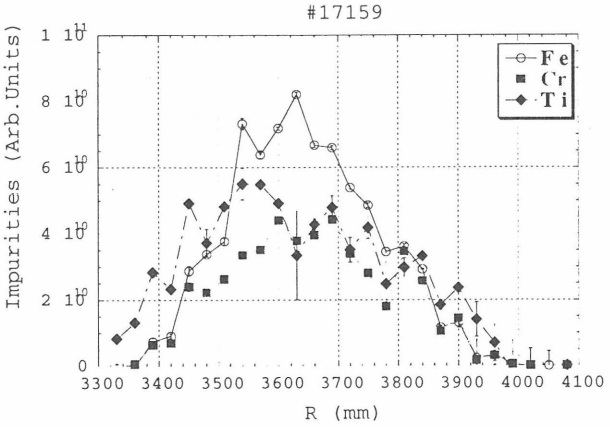

Fig.3. Intensity profiles of the impurity lines obtained from the experimental result.

Reference

1) Muto,S., *et al.*, (7th Int. Toki Conf., 1995), Fus.Eng.Des. **34-35** (1997) 205-207.